CLAIMS

I claim:

1. A bearing comprising:

a first ring having a first raceway constructed from a first metal or metal alloy;

a second ring having a second raceway constructed from a second metal or metal alloy;

a plurality of roller elements positioned between the first raceway and the second raceway; and

a lubricant disposed between the first raceway and the second raceway, the lubricant containing a plurality of suspended nanoparticles;

wherein the suspended nanoparticles are comprised of a third metal or metal alloy that is more anodic than the first metal or metal alloy.

2. The bearing of claim 1, wherein the third metal or metal alloy is more anodic than the second metal or metal alloy.

3. The bearing of claim 1, further comprising:

a first layer of a nanoparticle film disposed on at least a portion of the first raceway, the nanoparticle film is comprised of the suspended nanoparticles.

4. The bearing of claim 1, wherein the nanoparticles comprise zinc or zinc alloy.

5. The bearing of claim 4, wherein an average diameter of the suspended nanoparticles is approximately 10 nanometers.

6. The bearing of claim 4, wherein a diameter of the suspended nanoparticles is between approximately 10 nanometers and a maximum diameter entrainable between the roller and raceway.

7. The bearing of claim 6, wherein the maximum diameter entrainable between the roller and raceway is governed by the equation $R_{max} = \{[(r_i + R)^2 + 4\mu^2 R r_i]^{1/2} - (r_i + R)\}/2$, where R_{max} denotes the radius of the largest particle that the can be entrained.

8. The bearing of claim 4, wherein a concentration of the suspended nanoparticles in the lubricant is from about 0.2 percent to about 0.5 percent by weight.

9. The bearing of claim 4, wherein a concentration of the suspended nanoparticles in the lubricant is from about 0.2 percent to about 2.0 percent by weight.

10. The bearing of claim 4, wherein a concentration of the suspended nanoparticles in the lubricant is from about 2.0 percent to about 7.0 percent by weight.

11. A bearing comprising:

a first ring having a first raceway constructed from a first metal or metal alloy;

a second ring having a second raceway constructed from a second metal or metal alloy;

a plurality of roller elements positioned between the first raceway and the second raceway;

a first layer of a nanoparticle film disposed on at least a portion of the first raceway, wherein the nanoparticle film is comprised of a plurality of metal or metal alloy nanoparticles that are more anodic than the first metal or metal alloy.

12. The bearing of claim 11, wherein the nanoparticles comprise zinc or zinc alloy.

13. The bearing of claim 12, wherein an average diameter of the nanoparticles is approximately 10 nanometers.

14. The bearing of claim 12, wherein a diameter of the nanoparticles is between approximately 10 nanometers and a maximum diameter entrainable between the roller and raceway.

15. The bearing of claim 14, wherein the maximum diameter entrainable between the roller and raceway is governed by the equation

$R_{max} = \{[(r_i + R)^2 + 4\mu^2 R r_i]^{1/2} - (r_i + R)\}/2$, where R_{max} denotes the radius of the largest particle that the can be entrained.

16. The bearing of claim 12, wherein the nanoparticle film is approximately 0.0002 inches thick.

17. The bearing of claim 12, wherein the nanoparticle film contains a concentration of nanoparticles from about 0.2 percent to about 2.0 percent by weight.

18. The bearing of claim 12, wherein the nanoparticle film is from about 0.00002 inches to about 0.0025 inches thick.

19. The bearing of claim 11, wherein the nanoparticle film covers the entire first raceway.

20. The bearing of claim 11, further comprising a second layer of a nanoparticle film disposed on at least a portion of the second raceway, wherein the nanoparticle film is comprised of a plurality of metal or metal alloy nanoparticles that are more anodic than the second metal or metal alloy.

21. The bearing of claim 20, wherein the nanoparticle film covers the entire second raceway.

22. A bearing comprising:

a first ring having a first raceway having a first outer surface, the first raceway being constructed from a first metal or metal alloy;

a second ring having a second raceway having a second outer surface, the second raceway being constructed from a second metal or metal alloy;

a plurality of roller elements positioned between the first raceway and the second raceway; and

a lubricant disposed between the first raceway and the second raceway containing a plurality of suspended nanoparticles;

wherein the suspended nanoparticles are comprised of a third metal or metal alloy that is more anodic than the first metal or metal alloy; and

wherein the suspended nanoparticles fill at least some imperfections or pits in the first outer surface.

23. The bearing of claim 22, wherein the third metal or metal alloy is more anodic than the second metal or metal alloy.

24. The bearing of claim 22, wherein the suspended nanoparticles fill a majority of the imperfections or pits in the first outer surface.

25. The bearing of claim 22, wherein the suspended nanoparticles fill at least some imperfections or pits in the second outer surface.

26. The bearing of claim 25, wherein the suspended nanoparticles fill a majority of the imperfections or pits in the second outer surface.

27. A method of lubricating a bearing, wherein the bearing comprises a first ring having a first raceway constructed of a first metal or metal alloy and a second ring having a second raceway constructed of a second metal or metal alloy, the first raceway and the second raceway forming a channel therebetween, comprising the steps of:

disposing within the channel a lubricant containing a plurality of suspended nanoparticles; and

forming a first nanoparticle film on at least a portion of the first raceway, the first nanoparticle film being formed from the suspended nanoparticles;

wherein the suspended nanoparticles and the first nanoparticle film are comprised of a third metal or metal alloy that is more anodic than the first metal or metal alloy.

28. The bearing of claim 27, wherein the first nanoparticle film is formed by moving the roller elements over the first raceway.

29. The method of claim 27, further comprising:

forming a second nanoparticle film on at least a portion of the second raceway, the second nanoparticle film being formed from the suspended nanoparticles;

wherein the third metal or metal alloy is more anodic than the second metal or metal alloy.

30. The bearing of claim 29, wherein the second nanoparticle film is formed by moving the roller elements over the second raceway.

31. The bearing of claim 27, wherein the nanoparticles comprise zinc or zinc alloy.

32. The bearing of claim 31, wherein an average diameter of the suspended nanoparticles is approximately 10 nanometers.

33. The bearing of claim 31, wherein a diameter of the suspended nanoparticles is between approximately 10 nanometers and a maximum diameter entrainable between the roller and raceway.

34. The bearing of claim 33, wherein the maximum diameter entrainable between the roller and raceway is governed by the equation

$R_{max} = \{[(r_i + R)^2 + 4\mu^2 R r_i]^{1/2} - (r_i + R)\}/2$, where R_{max} denotes the radius of the largest particle that the can be entrained.

35. The bearing of claim 31, wherein the nanoparticle film is approximately 0.0002 inches thick.

36. The bearing of claim 31, wherein the lubricant contains a concentration of nanoparticles from about 0.2 percent to about 2.0 percent by weight.

37. The bearing of claim 31, wherein the nanoparticle film is from about 0.00002 inches to about 0.0025 inches thick.

38. The bearing of claim 31, wherein a concentration of the suspended nanoparticles in the lubricant is from about 0.2 percent to about 0.5 percent by weight.

39. The bearing of claim 31, wherein a concentration of the suspended nanoparticles in the lubricant is from about 0.2 to about 1.0 percent by weight.

40. The bearing of claim 31, wherein a concentration of the suspended nanoparticles in the lubricant is from about 2.0 percent to about 7.0 percent by weight.

41. The method of claim 27, further comprising:

disposing within the channel additional lubricant containing a plurality of suspended nanoparticles; and

forming a further first nanoparticle film on at least a portion of the first raceway, the further first nanoparticle film being formed from the suspended nanoparticles;

wherein the further first nanoparticle film is comprised of the third metal or metal alloy.

42. The bearing of claim 41, wherein the further first nanoparticle film is formed by moving the roller elements over the first raceway.

43. The method of claim 41, further comprising:

forming a further second nanoparticle film on at least a portion of the second raceway, the further second nanoparticle film being formed from the suspended nanoparticles;

wherein the further second nanoparticle film is comprised of the third metal or metal alloy.

44. The bearing of claim 43, wherein the further second nanoparticle film is formed by moving the roller elements over the second raceway.

45. A device comprising:

a first component constructed from a first metal or metal alloy;

a second component constructed from a second metal or metal alloy, wherein the second component is in sliding or rolling contact with an area of the first component; and

a first layer of a nanoparticle film disposed on at least a portion of the area of the first component, wherein the nanoparticle film is comprised of a plurality of metal or metal alloy nanoparticles that are more anodic than the first metal or metal alloy.

46. The device of claim 45, wherein the nanoparticles comprise zinc or zinc alloy.

47. The device of claim 46, wherein the nanoparticle film is approximately 0.0002 inches thick.

48. The device of claim 46, wherein the nanoparticle film is from about 0.00002 to about 0.0025 inches thick.

49. The device of claim 46, wherein the nanoparticle film contains a concentration of nanoparticles from about 0.2 percent to about 2.0 percent by weight.

50. A lubricant comprising nanoparticles that are anodic to steel in a concentration from about 0.2 percent to about 2.0 percent by weight.

51. The lubricant of claim 50 wherein the nanoparticles are comprised of zinc or zinc alloy.

52. A lubricant comprising nanoparticles that are anodic to steel in a concentration from about 2.0 percent to about 7.0 percent by weight.

53. The lubricant of claim 52 wherein the nanoparticles are comprised of zinc or zinc alloy.